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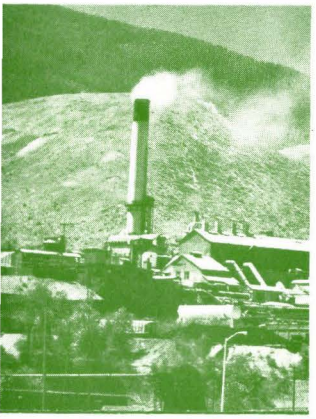

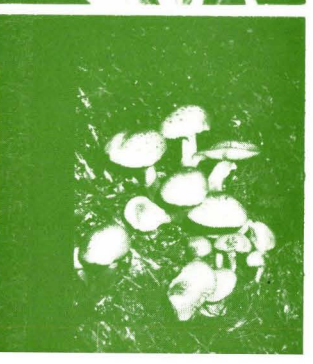

# FOREST INSECT & DISEASE MANAGEMENT

**USDA · FOREST SERVICE · NORTHERN REGION**
**State & Private Forestry · Missoula, MT 59801**

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Report No. 79-12 June 1979

## PILOT SURVEY TO MEASURE ANNUAL MORTALITY CAUSED BY THE MOUNTAIN PINE BEETLE IN LODGEPOLE PINE ON THE BEAVERHEAD, GALLATIN AND FLATHEAD FORESTS IN 1978

By

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PROGRESS REPORT

The purpose of this pilot survey is to measure damage caused by the mountain pine beetle (Dendroctonus ponderosae Hopk.) on State, private, and National Forest lands in Montana using aerial photography. The objectives and design are similar to earlier surveys conducted on the Targhee National Forest, Idaho; the Black Hills National Forest, South Dakota; and Wyoming (Klein et al. 1979; Hostetler and Young 1977).

The survey was designed to entail a randomized multistage sampling system initially stratified into two intensity classes or strata; with stratification to be made from current aerial sketchmap surveys and/or optical bar color infrared photography. Sketchmapping and stratification were followed by large-scale aerial photography and on-the-ground measurements to determine a ratio estimator for numbers of trees and volume killed. 1/

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1/ McGregor, Mark et al. Pilot surveys to measure annual mortality caused by the mountain pine beetle in lodgepole pine on the Beaverhead, Gallatin, and Flathead National Forests, and in ponderosa pine on the Lewis and Clark National Forest, Montana. Work Plan, p. 5, 1978.

## STRATIFICATION

The initial stratification was made from aerial survey sketchmaps which were completed August 15, 1978. Three strata were delineated to minimize the variance of estimates of totals (table 1). The optical bar photography was not used for stratification at this point as it was not received from processing until September 25, 1978.

Table 1.--Stratification by intensity class and allocation of photo plots and ground plots per stratum

| Stratum | Est. No. of trees | Acres | Trees per acre | No. of polygons | No. of photo plots (40-acre) | No. of ground plots (2.5-acre) |
|---|---|---|---|---|---|---|
| Light | 337,270 | 179,375 | 0.14.9 | 236 | 94 | 24 |
| Moderate | 345,400 | 52,231 | 5.09.9 | 49 | 24 | 16 |
| Heavy | 651,350 | 38,649 | 10.0 | 37 | 26 | 16 |
| Out | | | | | 134 | 0 |
| Total | 1,333,920 | 270,280 | | 322 | 278 | 56 |

## LARGE-SCALE PHOTO PLOTS

Approximately 100 40-acre photo plots were to be flown and photographed by September 1, 1978. However, problems with contract letting, contractor scheduling conflicts, and inclement weather resulted in a lengthy delay of photo flights.

The Gallatin-Beaverhead infestation was flown and photographed October 3-5. Photography of the Flathead and Lewis and Clark infestations was canceled due to heavy snows. Therefore, surveys were limited to the Gallatin-Beaverhead infestation. Due to the onset of winter snows, ground checking was postponed until late spring/early summer.

## PHOTO INTERPRETATION

By December 19, 1978, all 144 40-acre photo plots were located on Forest maps and arranged according to stratum (table 1). Each plot was subdivided into sixteen 2.5-acre subplots, then photo interpreted with counts made of all 1978 faders. Counts were kept separate according to subplot designation.

To determine the best system, each photo plot was interpreted monoscopically (microfiche viewer) and stereoscopically (Old Delph stereoscope). A valid comparison will be made when ground truth data has been collected.

## GROUND PLOTS

From the photo plots, fifty-six 2.5-acre ground plots were selected by probability proportional to size (pps) sampling. Each ground plot was then located on Forest maps, USDI-GS maps, and small-scale aerial photography (1:80,000). Finally, each plot was scribed on large-scale (1:6,000) color photography.

Field crews began collecting ground truth data on May 14, 1979, and should finish prior to beetle flight. Deep snow at higher elevations prohibits access and prevents survey of many ground plots at this time.

## OPTICAL BAR PHOTOGRAPHY

Small-scale (1:30,000), high-definition, color infrared photography was taken in July from a U2 aircraft with a panoramic camera. This photography covered mountain pine beetle infested areas of lodgepole pine on the Beaverhead, Flathead, and Gallatin National Forests.

During February and March, photo interpreters from Forest Insect and Disease Management, Regions 1, 3, 5; Methods Application Group; and Lockheed Forestry Applications stratified the Gallatin-Beaverhead infestation, then made counts of 1978 faders within pps selected 160-acre plots. From these, thirty 10-acre ground plots will be selected, and ground truth data will be collected by mid-July.

## FINAL ANALYSIS AND REPORT

Analysis of the ground data and photo interpretation correlations will be made by September 1, 1979. A final report of the annual and cumulative mortality of lodgepole pine caused by mountain pine beetle on the Gallatin and Beaverhead National Forests (including other ownerships) will be released by October 1, 1979.

A schedule of work completion dates is shown on the following page.

## SEQUENCE OF EVENTS

| Event | Date Completed | Date to be Completed |
|---|---|---|
| GALLATIN-BEAVERHEAD SURVEY | | |
| Aerial Surveys | August 15, 1978 | |
| Stratification From Aerial Survey Maps | ? | |
| Large-Scale Photographs | | |
| Flown | October 3-5, 1978 | |
| Processed | October 15, 1978 | |
| Received | October 30, 1978 | |
| Photo Interpreted | December 19, 1978 | |
| Ground Plot Data Collected | | July 15, 1979 |
| Data Analyzed | | September 1, 1979 |
| Final Report | | October 1, 1979 |
| Small-Scale Photographs | July 25, 1978 | |
| Flown | | |
| Processed | August 8, 1978 | |
| Received | September 25, 1978 | |
| Stratified | March 2, 1979 | |
| Photo Interpreted | May 11, 1979 | |
| Ground Plot Data Collected | | July 15, 1979 |
| Data Analyzed | | September 1, 1979 |
| Final Report | | October 1, 1979 |
| FLATHEAD SURVEY (canceled) | | |
| LEWIS & CLARK SURVEY (canceled) | | |

## REFERENCES

Hostetler, Bruce B., and Robert W. Young. 1979. A pilot survey to measure annual mortality of ponderosa pine caused by the mountain pine beetle in the Black Hills of South Dakota and Wyoming. Technical Report R2-15. Forest Insect and Disease Management, Rocky Mountain Region, Forest Service, USDA, Fort Collins, CO.

Klein, William H., Dayle D. Bennett, and Robert W. Young. 1979. A pilot survey to measure annual mortality of lodgepole pine caused by the mountain pine beetle. Report No. 78-4. Intermountain Region and Methods Application Group, Forest Insect and Disease Management, Forest Service, USDA, Davis, CA.